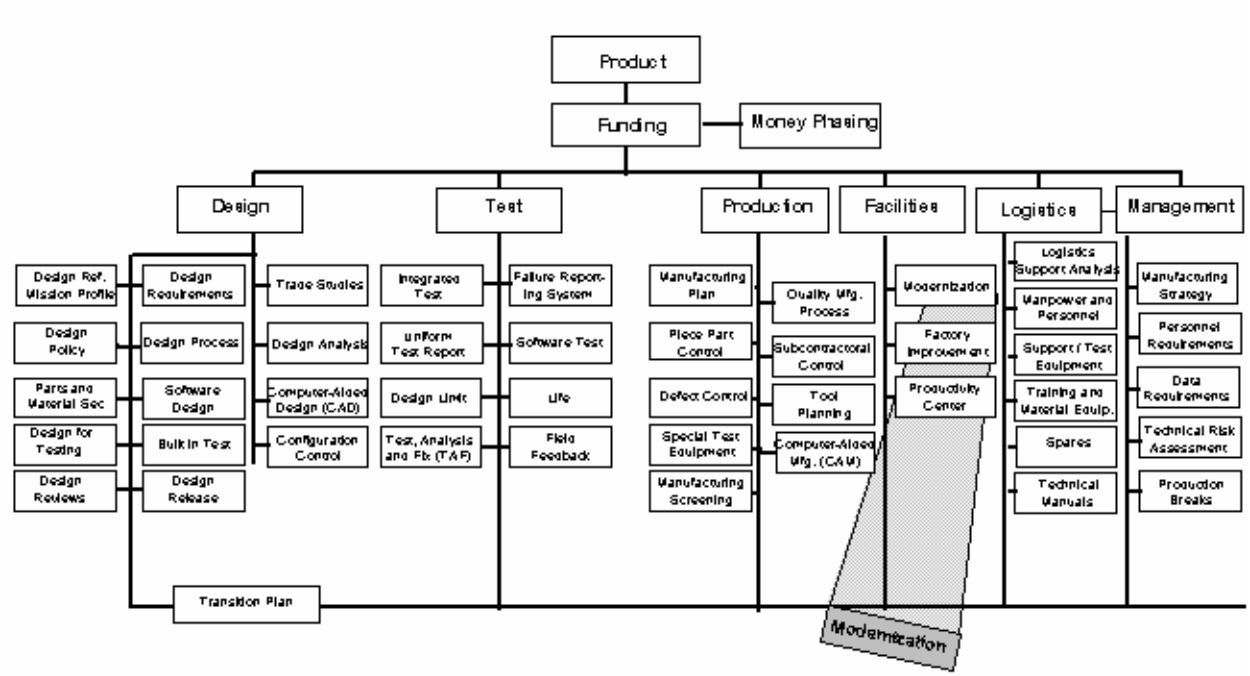
Previous Section

Chapter 7 -- Facilities

A. -- Introduction for Facilities and Capital Investment Critical Path Templates

Three templates are provided in this section. The first, Modernization, is based on DoD's new Industrial Modernization Incentive Program (IMIP) that permits profits to increase as modernization activities reduce costs to produce. The second, Factory Improvements, is an outline of an electronics factory that contains the equipment required to implement a low risk manufacturing operation. The third, Productivity Center, is a method for upgrading the skills of personnel using the new equipment and processes on the factory floor.

B. -- Modernization



Area of Risk

Current approaches to Government contracting fundamentally inhibit industry investments to modernize. Why? Profits are a fixed percent of the cost to produce. See figure 7-1. The rate of modernization is low because profits go down as costs to produce go down. The capital to invest in modernization activities is not available in Government business. Why modernize? Increased productivity reduces costs to produce. The defense industrial base surge capability is improved. U.S. industry's position in the international marketplace has improved. The increased market improves the U.S. balance of payments and produces more jobs. Automation improves quality. The talent, material, and computer software required to implement the design and manufacturing

fundamentals for reliable products are made possible by increased capital, and reduce the risk of transitioning from development into production.

Outline for Reducing Risk

- The DoD IMIP permits profits to increase as costs to produce decrease. This provides additional capital that is available to increase the rate of modernization that increases productivity and further reduces production costs, and thus overall costs to acquire defense material. See figure 7-2. The objective is to increase the rate of modernization.

- Single product incentives are considered, when appropriate. These incentives result in contractor proposals for major productivity enhancements, limited overall factory modernization, and large unit cost savings. Unit cost savings examples (using 1982 dollars) are as follows:

Item	Investment	Savings To Date	EST.Total Savings
Cross Field Amplifier	$256,000		$22,300,000
Radome	116,000	$350,000 (1982)	4,000,000
Torpedo Propeller	286,000		15,500,000

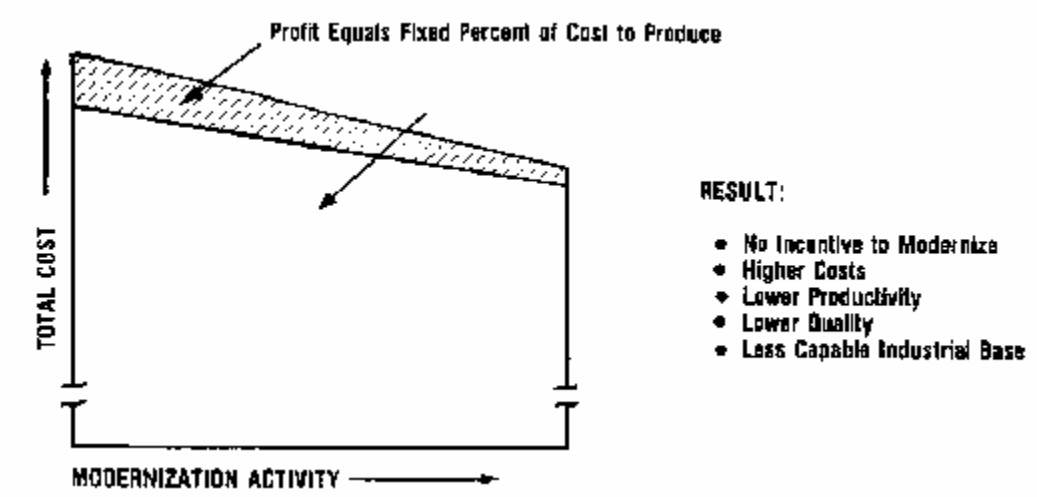


Figure 7-1. -- The Old Approach

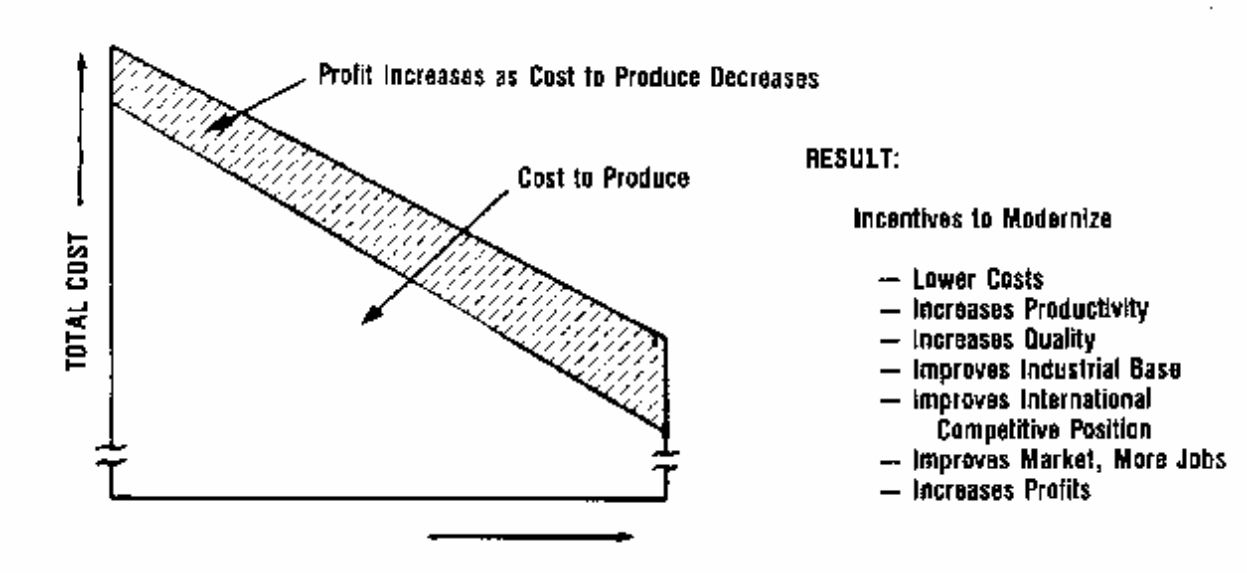


Figure 7-2. -- The New Approach (IMIP)

• Multiple product incentives are considered, when appropriate. These incentives result in contractor proposals for major product-oriented productivity enhancements and factory modernization improvements. An example of results:

– Savings: initial investment = $70,000,000 estimated savings = 430,000,000

– Modernization improvements: automated material handling, automated assembly of cables and harnesses, and automated printed wiring assembly station.

• The multiple product, . single DoD focal point concept is utilized. When a factory deals with a single DoD focal point as the customer for all its products and profits increase as costs to produce decrease, modernization of the DoD industrial base may take care of itself.

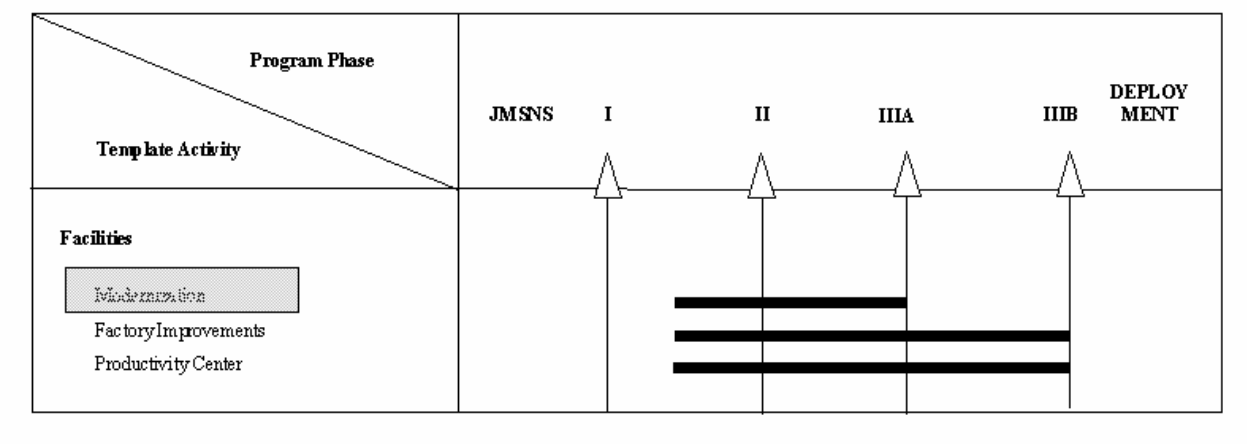
• Modernization activities are checked carefully against their impact on life cycle Cost, i.e., product quality.

• Contractor funding of modernization activities is preferred by the Government, and resultant savings are shared by the contractor and the Government. The contractor's investments are guaranteed by the Government, when appropriate.

• Modernization activities are flowed down to subcontractors and suppliers, to accrue the greatest benefits.

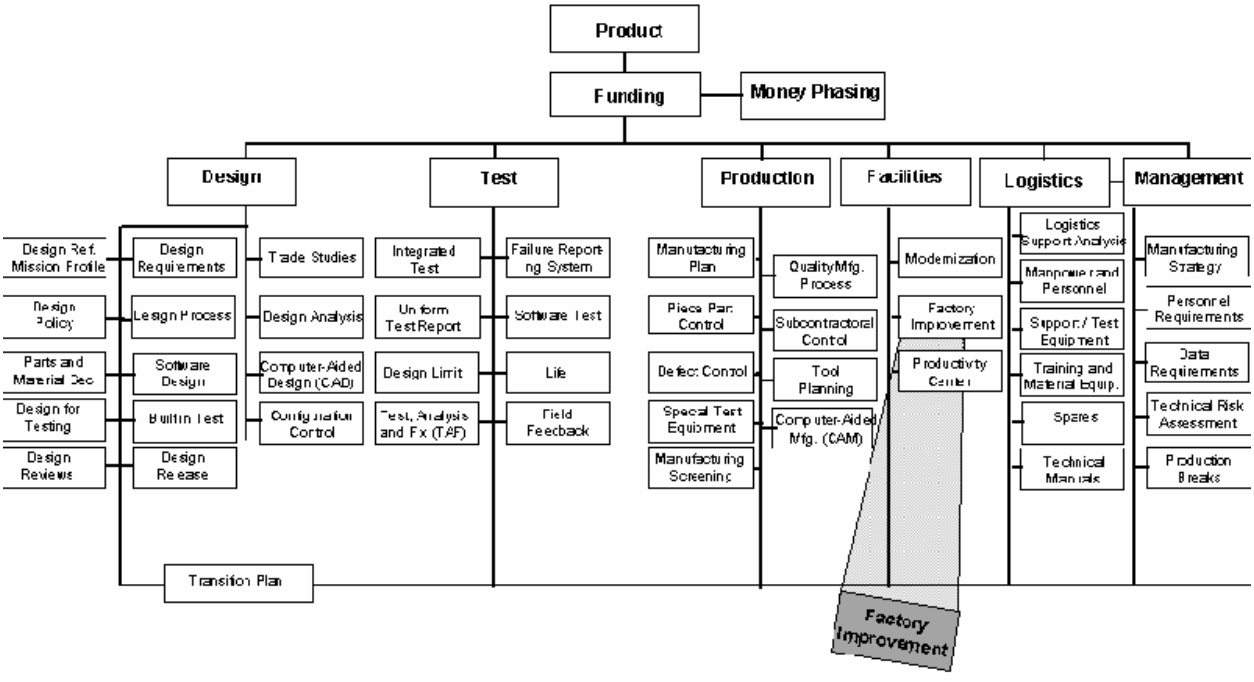
• All defense materials, not just weapon systems, are considered candidates for modernization activities.

Timeline



Factory modernization is essential to cost-effective production of today's sophisticated weapon systems. Modernization activities primarily are oriented to support ail of the factory's product lines. However, there may be program-related activities. In these cases, detailed planning is done early enough to influence the design, as appropriate and required.

C. -- Factory Improvements



Area of Risk

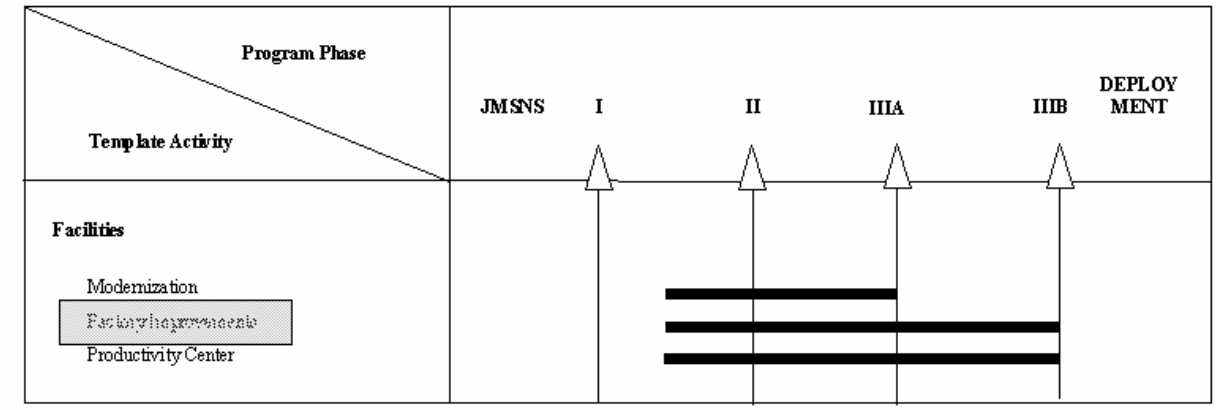
Many equipment failures in the field can be attributed to excessive manual assembly and test operations in the manufacture of assemblies. In-plant failures from manual errors in assembly and test contribute to excessive rework and repair costs (i.e., "the hidden factory"). These risk areas increase production and life cycle costs and result in major schedule risks. These risks are acute particularly during the transition from development to production. The use of

semiautomatic equipment in electronics manufacturing is essential in reducing these risks. This template illustrates an optimum facility for electronics assembly and test using available "off-the-shelf" electronics manufacturing equipment.

Outline for Reducing Risk

- Incoming inspection and automatic kit preparation ensure that high quality and correct components are used on the assembly line.
  - Typically, an 80 percent reduction in component defects can be achieved.
  - Exhibit 7-1. generically illustrates an example of incoming inspection and kit preparation areas.
- Semiautomatic and fully automated circuit board assembly techniques increase productivity and minimize assembly and workmanship defects.
  - Typically, a 2:1 reduction in defect rates can be achieved.
  - Exhibit 7-2. generically illustrates an example of a circuit board assembly and test area.
- Semiautomatic assembly and test techniques maximize productivity and minimize workmanship defects on electronic assemblies.
  - Typically, a 3:1 improvement in productivity can be achieved.
  - Exhibit 7-3. generically illustrates an example of an electronics subassembly and test area.
- One hundred percent piece part inspection of electronic parts reduces risk, is cost-effective, and should be a routine operation in incoming inspection.
- A productivity center for personnel training and development of any equipment integration minimizes the risk of unforeseen throughput problems.
- Computer-assisted functions include a data interface between the design and operations management functions.
- Each assembly, test, and inspection station should have computer-aided data entry capability.

Timeline

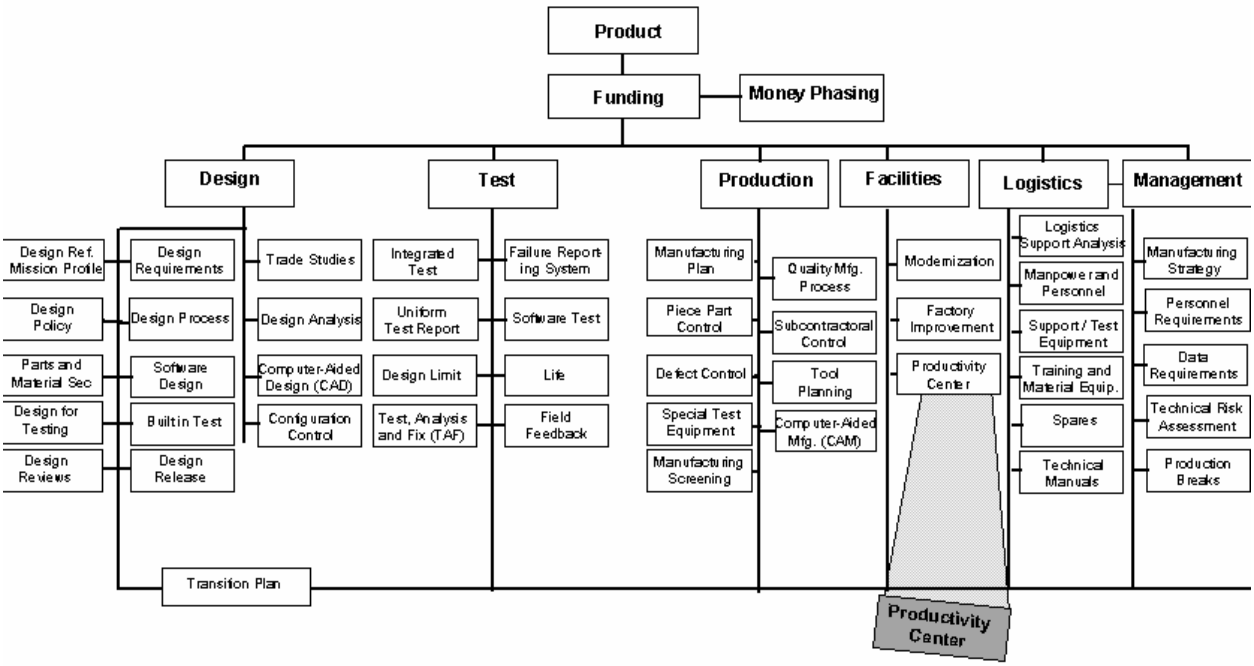


The use of state-of-the-art factory equipment can prevent many common workmanship errors. The type of facility planned for the manufacture of the end item product should be identified during engineering development, and should be evaluated periodically from development until full rate production is achieved.

Note:

1. ***Exhibit 7-1. -- Incoming Inspection and Kitting (Not applicable under this formate.)***
2. ***Exhibit 7-2. -- Printed Circuit Board Assembly and Test (Not applicable under this formate.)***
3. ***Exhibit 7-3. -- Electronics Assembly and Test (Not applicable under this formate.)***

D. -- Productivity Center



Area of Risk

The use of changing technology on the factory floor without qualified personnel can be counterproductive, lowering or eliminating the productivity gains anticipated from the capital investment in modernization and factory improvement. Thus, maintaining a stable labor force as new technology is introduced on the factory floor is a risk area. This risk area is amplified with the introduction of new "state-of-the-art" products that are typical of today's military weapon systems. Training and maintaining the skill of the labor force, therefore, presents a significant risk in the transition to production. A productivity center that updates the skills of the work force and provides orientation training for new product lines is a catalyst for maintaining a well-trained labor force. This template provides a framework for an effective productivity center.

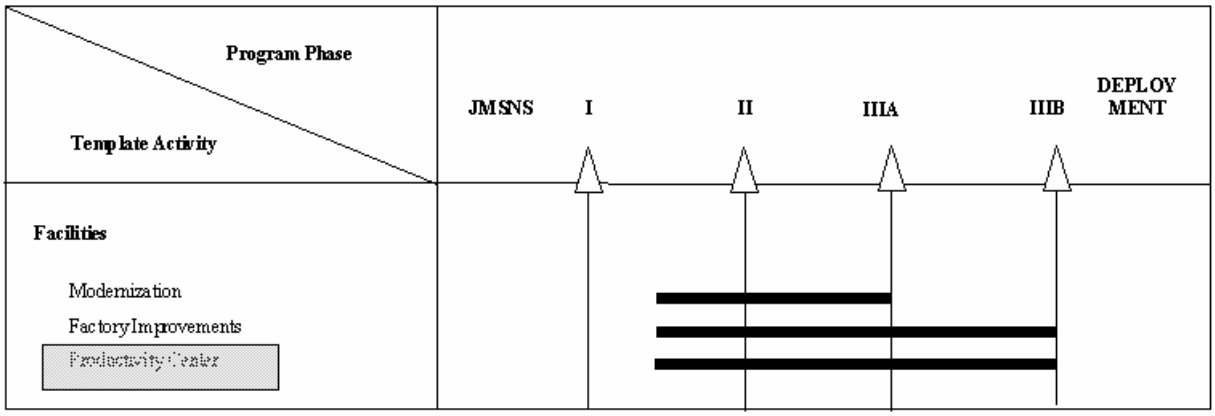
Outline for Reducing Risk

- productivity center includes an apparatus lab that contains the equipment and technologies that represent the actual facility producing a product.
  - Use of the apparatus lab includes simulation of production equipment hardware and end item defects.
  - The apparatus lab evaluates new processes or process changes before introduction at the main facility. This technique ensures that any change to existing procedures will not affect adversely normal production flow.
- Productivity center includes a learning center for classroom instruction for updating the skills of manufacturing personnel.
- Training system is flexible and individual performance oriented.
  - Sixty percent is "hands on" training in apparatus lab.
  - Forty percent is formal classroom instruction.
  - Attention is given to skill assessment and the motivation aspects of worker retraining.
- Typical training courses include the following:
  - Product orientation.
  - Manufacturing facility orientation.
  - Electronics manufacturing and test operations and procedures.
  - Numerical control machine operations.
  - CAM.
  - Diagnostics for troubleshooting and repair (system level).

– Microprocessor troubleshooting techniques.

– Computer technology.

Timeline



A productivity center provides an "off-line" capability to evaluate manufacturing techniques for worker retraining for production line improvements. As new technology, equipment, manufacturing processes, or test procedures are identified for the efficient production of a specific product, personnel must be trained to perform these new tasks. Manufacturing engineering concurrent with design engineering will identify these tasks during development, and additional tasks will be identified until rate production has been achieved.

Next Section